Patent claims

1. A vector for inserting a nucleic acid into a cell, which vector ~~contains~~ comprises a low molecular weight polyethylenimine (LMW PEI) and a nucleic acid, ~~with~~ wherein the LMW PEI having a molecular weight of less than 50,000 Da.

2. ~~A~~ The vector as claimed in claim 1, wherein the LMW PEI has a molecular weight of from 500 to 30,000 Da.

3. ~~A~~ The vector as claimed in ~~either of~~ claims 1 ~~and 2,~~ wherein the LMW PEI has a molecular weight of from 1000 to 5000 Da.

4. ~~A~~ The vector as claimed in ~~one or more of~~ claims 1 ~~to 3,~~ wherein the LMW PEI has a molecular weight of about 2000 Da.

5. ~~A~~ The vector as claimed in ~~one or more of~~ claims 1 ~~to 4,~~ wherein the nucleic acid is a viral or nonviral nucleic acid construct.

6. ~~A~~ The vector as claimed in ~~one or more of claims 1 to 5,~~ claim 1 wherein the nucleic acid construct contains one or more effector genes.

7. ~~A~~ The vector as claimed in ~~one or more of claims 1 to 6,~~ claim 1 wherein at least one effector gene encodes a pharmacological active compound or its prodrug form.

8. ~~A~~ The vector as claimed in ~~one or more of claims 1 to 7,~~ claim 1 wherein at least one effector gene encodes an enzyme.

9. ~~A~~ The vector as claimed in ~~one or more of claims 1 to 8,~~ claim 1 wherein at least one effector gene is expressed together with a cell-specific ligand as a fusion protein.

10. ~~A~~ The vector as claimed in ~~one or more of claims 1 to 9,~~ claim 1 wherein the LMW PEI is coupled to a cell-specific ligand.

11. ~~A~~ The vector as claimed in ~~one or more of claims 1 to 10,~~ claim 1 wherein the cell-specific ligand binds to the outer membrane of a target cell.

12. The vector as claimed in ~~one or more of claims 1 to 11,~~ wherein the target cell is an endothelial cell, a muscle cell, a macrophage, a lymphocyte, a glia cell, an hematopoietic cell, a tumor cell, a virus-infected cell, a bronchial epithelial cell or a liver cell.

13. The vector as claimed in ~~one or more of claims 1 to 12,~~ wherein the ratio by weight of LMW PEI to nucleic acid is 3:1 or more.

14. The vector as claimed in ~~one or more of claims 1 to 13,~~ wherein the ratio by weight of LMW PEI to nucleic acid is 8:1 or more.

15. A process for preparing a low molecular weight polyethylenimine (LMW PEI) having a molecular weight of less than 50,000 Da, which comprises monomeric ethylenimine being polymerized in aqueous solution by adding hydrochloric acid.

16. The process as claimed in claim 15, wherein the aqueous solution is from 0.1% strength to 90% strength with respect to monomeric ethylenimine and from 0.1% strength to 10% strength with respect to concentrated hydrochloric acid.

17. The process as claimed in ~~either of claims 15 and 16,~~ wherein the polymerization is carried out at a reaction temperature of from 30°C to 70°C.

18. The process as claimed in ~~one or more of claims 15 to 17,~~ wherein the reaction time is from 1 to 30 days.

19. A low molecular weight polyethylenimine which has a molecular weight of less than 50,000 Da and which is prepared by a process according to ~~one or more of claims 15 to 18.~~

20. The use of a low molecular weight polyethylenimine having a molecular weight of less than 50,000 Da for preparing a vector as claimed in one or more of claims 1 to 14.

21. A process for preparing a vector according to ~~one or more of claims 1 to 14,~~ which comprises mixing an appropriate quantity of

LMW PEI with an appropriate quantity of nucleic acid in an aqueous solution.

22. The use of a vector as claimed in one or more of claims 1 to 14 for inserting a nucleic acid into a cell.

23. The use of a vector as claimed in claim 22, wherein the cell is an endothelial cell, a lymphocyte, a macrophage, a liver cell, a fibroblast, a muscle cell or an epithelial cell.

24. A process for preparing a transfected cell, which comprises incubating a vector as claimed in ~~one or more of claims 1 to 14~~ claim 1 in vitro with this cell.

25. A transfected cell which contains a vector as claimed in ~~one or more of claims 1 to 14.~~ claim 1

26. The use of a transfected cell as claimed in claim 25 for preparing a pharmaceutical.

27. The use of a low molecular weight polyethylenimine as claimed in claim 19 for preparing a pharmaceutical.

28. The use of a vector as claimed in one or more of claims 1 to 14 for preparing a pharmaceutical.

29. The use of a vector as claimed in one or more of claims 1 to 14 for preparing a pharmaceutical for gene therapy.

30. A process for preparing a pharmaceutical, which comprises mixing a nucleic acid with an LMW PEI.

31. A pharmaceutical which comprises a vector as claimed in ~~one or more of claims 1 to 14.~~ claim 1

32. A pharmaceutical which comprises an LMW PEI as claimed in claim 19.

33. A pharmaceutical which comprises a transfected cell as claimed in claim 25.